PRACTICAL-6

Aim:- Compare colab cpu, gpu, tpu

Google Colab provides three types of hardware accelerators: **CPU**, **GPU**, and **TPU**. Each has different capabilities in terms of speed, parallelism, and suitability for various machine learning tasks. This practical aims to compare their performance in terms of computation speed and resource utilization.

Hardware	Full Form	Purpose	Strengths	Weaknesses
CPU	Central Processing Unit	General-purpose processing	Flexible, good for light tasks and data preprocessing	Slow for deep learning, limited parallelism
GPU	Graphics Processing Unit	High-performance parallel computation	Very fast for deep learning and matrix operations	High energy consumption, overkill for simple tasks
TPU	Tensor Processing Unit	Specialized hardware by Google for machine learning	Extremely fast for large-scale ML models, optimized for TensorFlow	Less flexible, needs TensorFlow models

Key Differences

- **Parallelism**:
    - CPU: Low parallelism (few cores).
    - GPU: High parallelism (hundreds to thousands of cores).
    - TPU: Massive parallelism, specially optimized for tensor operations.

- **Use Cases**:
    - CPU: Best for code development, small models, data preprocessing.
    - GPU: Best for training deep learning models (CNNs, RNNs).
    - TPU: Best for massive TensorFlow models, production-level training.

- **Speed**:
    - CPU < GPU < TPU (for deep learning tasks).

- **Ease of Use**:
    - CPU and GPU are easier to use with any ML framework.
    - TPU often requires slight modifications to code (e.g., TensorFlow-specific functions).

Why This Comparison Matters

Choosing the right hardware can **save hours of training time** and **reduce costs**.

- For small models → CPU is enough.
- For moderate models → GPU gives a huge speedup.

- For very large TensorFlow models → TPU can drastically reduce training time.

Expected Observations in Practical

- On **CPU**, model training is slow.

- On **GPU**, model training speeds up significantly (3–10× faster than CPU).

- On **TPU**, model training is even faster, especially for very large datasets (10–50× faster than CPU).

However, for very small models, TPU overhead might cause it to be slower than GPU!